# IEEE P1547 - Interconnecting DR with Electric Power Systems

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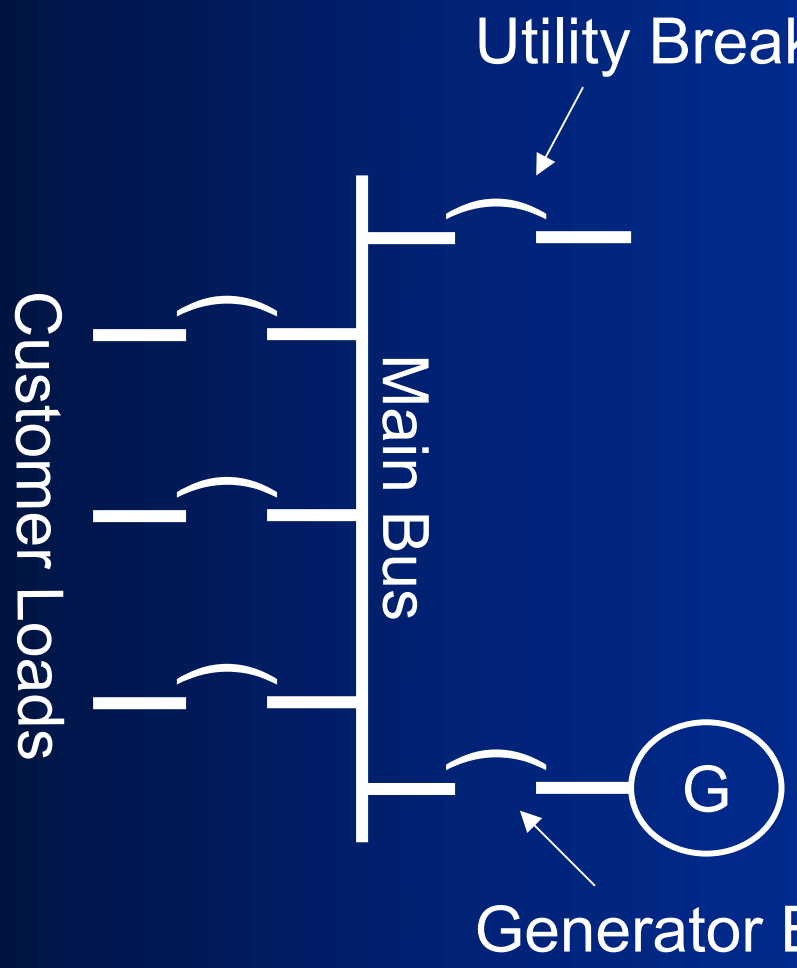
# What is Interconnection?

- Operating a generator with the output electrically connected to the “grid”
- AKA:
  - Parallel operation
  - Grid Connected
- Not the same as emergency or standby generation where the generator is never electrically connected to the utility system

# What is Interconnection?




Generator is interconnected if Generator Breaker and Utility Breaker can be closed at the same time.

# Generators That Might Interconnect

Photovoltaic

Microturbines

Wind

Reciprocating Engines

Fuel Cells

# Why is Interconnection a Barrier to DG?

- No Uniform Interconnection Rules or Standards
  - Requirements Vary From Utility to Utility
  - Unpredictable Cost
- Unlike Transmission, Utility Distribution Systems Have Been Designed for One Way Power Flow
  - DG Creates Problems with Overcurrent Protection, Voltage Regulation, and Safety, Just to Name a Few

# IEEE P1547

- Addresses the “uniform standard” issue
- Technical specifications and requirements to interconnect generators with aggregate capacity of 10 MVA or less with the electric power system

# IEEE P1547 History & Status

- Working Group initiated activity in 1998
- September 2002 - Ballot of Draft 10 passed Working Group with 90% affirmative vote
- March 2003 - Addressed negative votes resulting in recirculated Draft 11 which passed with 91% affirmative vote
- Next Step - IEEE Standards Board approval anticipated for June 2003

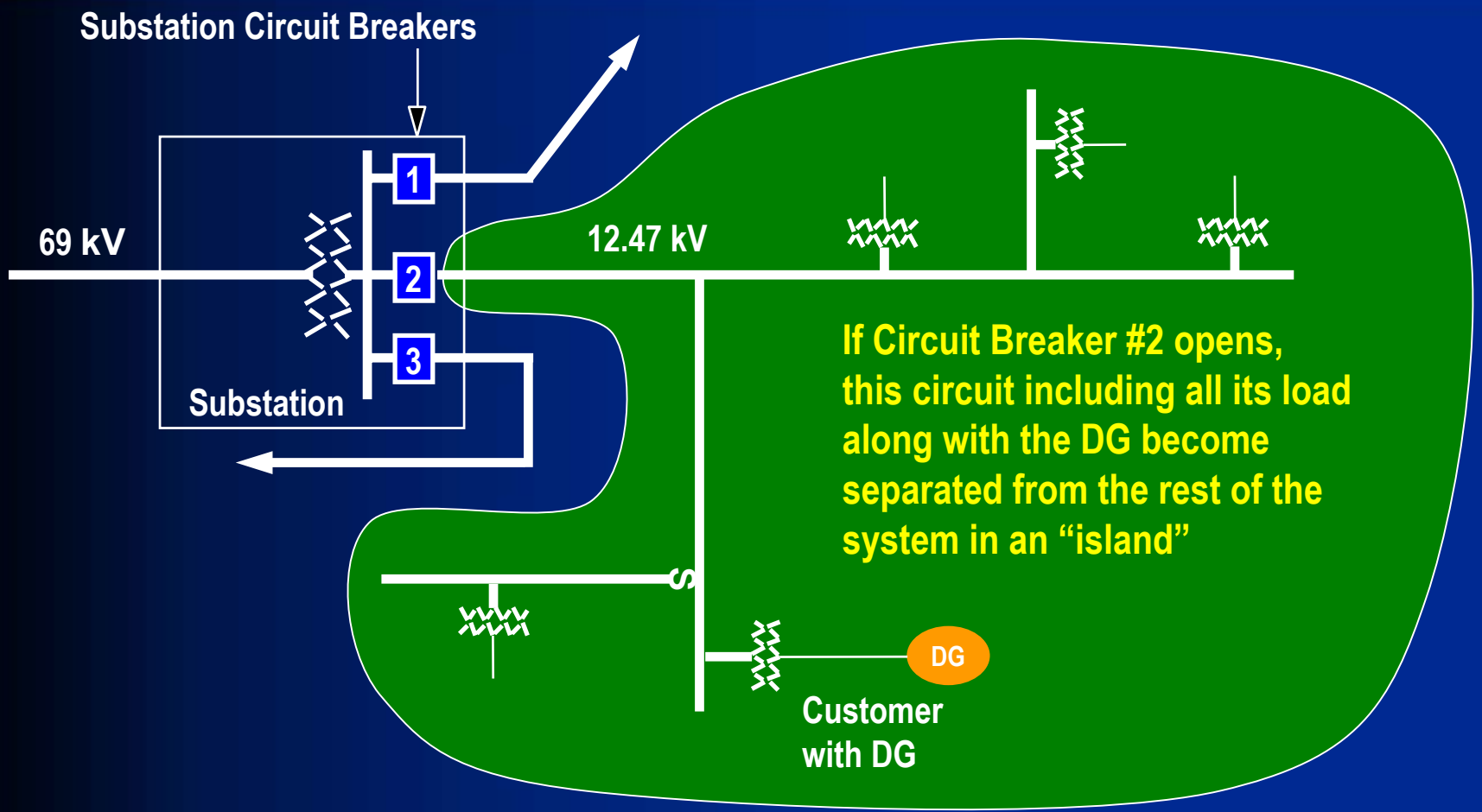
# IEEE P1547 Technical Issues

- Determination that some requirements are met can be done by type testing of interconnection equipment
  - Response to abnormal voltage & frequency
  - Synchronization
  - Interconnect Integrity
  - Unintentional islanding (active techniques only)
  - Limitation of DC Injection
  - Harmonics
- "Certification" concept
  - Does not imply that all interconnection requirements are met and the device can be used anywhere

# IEEE P1547 Technical Issues

- Determination that other requirements are met can only be done by an installation design evaluation that includes utility system characteristics at the DR site.
  - Impact on utility system voltage
  - Grounding integration
  - Isolation device
  - Area EPS fault sensing
  - Reclosing coordination
  - Flicker
  - Unintentional Islanding (passive techniques)

# Unintentional Islanding



# Technical Issues Not Addressed by IEEE P1547

- Impact on utility overcurrent protection scheme
- Penetration limits
  - There is a lot we don't know about the effects of significant DG penetration.
- Redundancy
- Acceptable methods to meet requirements
- Dynamic character of distribution systems
  - Loads change - increasing or decreasing
  - Configuration changes frequently

# Screens

- Is the Interconnection Simple or Complex?
- Way to determine situations where:
  - The likelihood is high that a certified device will work with little or no additional requirements
  - The effort needed to evaluate conformance with non-certifiable requirements is very minimal

# The Whole Interconnection Picture

- Technical Standard - IEEE P1547
- Technical Issues not addressed by P1547
- Application & Approval Procedures
  - Who to contact
  - How long should it take
  - Fees
  - Screens
- Responsibilities of DG & Utility
  - Who pays for what
  - Interconnection Agreement

# Additional P1547 Series Documents Under Development

- P1547.1 Standard for Conformance Tests
- P1547.2 Application Guide
- P1547.3 Guide for Monitoring, Information Exchange and Control
- Ongoing revision of P1547

# Key Points

- IEEE P1547 provides uniform technical requirements. This paves the way for “certification”
- However, some of the IEEE P1547 requirements cannot be pre-certified
- Some technical issues, particularly those dealing with utility system impact, are not covered by IEEE P1547
- Distribution systems are dynamic. An interconnection scheme could be designed that will work with existing conditions but will not work if the configuration or load changes